

which must furnish the terms of ultimate analysis . . . and are led to the discovery of the impressive continuity as existent between the responses of the most complex living and the simplest inorganic matter."

Sensibility is the power to feel, and is the function of the cerebral cortex of man, and also, we may assume justly from the similarity of the neuromuscular reactions, the function of the brain of the higher animals. That it is a function of the fish or frog brain we cannot affirm with any certainty. To ascribe it to a plant or wire is altogether unwarrantable.

A similar condition of molecular strain may be present in a wire, a plant stem, and a nerve fibre, and give the same electrical response, but this is not sensibility, and we even cannot conclude justly from the similarity of electrical response that the same mechanism is present.

Suppose we see a cloud of steam rising over the wall of a field. It may be from a traction engine, from a dung heap, or from a team of horses heated with ploughing. Observations on the direction of the current of steam, and on the effect of modifying agents upon it, will tell us nothing as to the nature of the chemical process which results in the manifestation of heat and the evaporation of water. Prof. Bose's philosophy seems almost capable of asserting that the similarity in direction of the steam current proves the sensibility, not only of the horses, but of all three structures.

Apart from these criticisms, there are in Prof. Bose's book a great many very interesting observations and ingenious methods of experimentation which will repay the reader's attention. In particular, his experiments on root pressure and the rise of sap; those by which he seeks to demonstrate that not only sensitive plants but all plants respond to excitation by variations in turgescence and electrical state; his comparison of the glandular structures of sundew and pitcher plants with animal glands; his demonstration of Dr. Waller's "blaze current" in a brominated lead plate and assertion that it cannot be regarded as a sign of life; his demonstration on the motile leaflets of *Biophytum* of the anodic and cathodic effects of the constant current, and the velocity of transmission of excitatory waves; his comparison of retentiveness of molecular change in metals with memory. In fact, the whole book abounds in interesting matter skilfully woven together, and would be recommended as of great value if it did not continually arouse our incredulity.

L. H.

THE STEREOSCOPE AND STEREOSCOPIC INSTRUMENTS.

Die binokularen Instrumente. By Moritz von Rohr. Pp. viii+223. (Berlin: Julius Springer, 1907.) Price 6 marks.

THE scientific staff of the Zeiss firm have of late years devoted much attention to the theory of binocular instruments, and to the development of methods of measurement depending on stereoscopic

vision. The impetus given by the successful realisation of the prism field-glass has carried them on to a more exact examination of the conditions under which binocular vision can be employed for the accurate determination of relative position, which has led to the design of a series of new instruments for surveying and other purposes, of which the stereocomparator is the most widely known.

The thoroughness with which the problem has been considered is sufficiently illustrated by the present work of von Rohr, who has already in his previous writings dealt very completely with the theory of vision by means of binocular instruments. This previous work he has now supplemented with an examination into the historical evolution of stereoscopic instruments, systematically planned with the view of clearing the ground and avoiding loss of labour from the re-development of ideas already investigated by previous workers. The book is divided into three parts; the first gives in a few pages a concise statement of the theory; then follows the history, to which part i. is merely an introduction; and the volume concludes with a most useful systematic summary of the matter contained in part ii., assisted by what may be described as a logical guide arranged in the form of a genealogical table, showing the subdivisions of the subject and referring to the place of treatment. This third part, of course, includes a bibliography.

The history begins seriously with the work of Ch. Wheatstone, who is even better known as an electrician. Reference is indeed made to some previous writers and instruments, from the early binocular of Lipperhey, and the suggestive experiments of R. Smith. One notices some omissions here, but the book makes no pretence to be exhaustive; the object is only to trace out the development of correct principles of construction, and to indicate the most important workers and the advances due to them. From this aspect the book is almost too thorough and complete.

Much space is devoted to the famous controversy between Sir David Brewster and Wheatstone, again because of its value for the development of the theory. It is now generally recognised that Wheatstone had the much more correct grasp of the principles, and that the popularity of the Brewster type of prism stereoscope as against the Wheatstone mirror instrument was due to its superior handiness, which outweighed its optical deficiencies. It is interesting to note that Brewster records the sale of prism stereoscopes from the time of the Great Exhibition to 1856 as amounting to more than half a million; these for the most part on the improved mechanical design of Duboscq. One can still remember the wide interest aroused by this method of obtaining pictures in relief.

The interest, however, soon died down, only to be revived in comparatively recent years. The simple stereoscope was gradually improved, as well as the binocular microscope, and more especially the binocular field-glass. The advances of photography were accompanied by the invention of various methods of obtaining "stereograms." But public interest only revived with Abbe's introduction of the prism binocular. Since then Jena has been the centre for the spread of renewed enthusiasm for the subject, while

in this country few developments have been made. More attention has been given probably in England to the binocular microscope than to any other form of stereoscopic instrument. Quite recently Theodore Brown has experimented with a method of monocular bio-stereoscopic projection, which will doubtless one day be perfected and become widely known. But only his earlier work is mentioned by von Rohr, who does not carry his account beyond 1900. For the same reason, perhaps, we find no mention of the Forbes stereoscopic range-finder, or of the Aitchison prism binocular.

To those interested in the history of optics, and more especially to workers in stereoscopy, von Rohr's compilation will be of great value. For the general reader it is to be feared the technical manner in which the subject is presented throughout will prove somewhat of a stumbling block. This is, we think, a matter for regret.

AMERICAN PHYSICAL GEOGRAPHY.

Physiography. By Prof. R. D. Salisbury. Pp. xx+770; xxvi plates, 707 figures. (London: J. Murray, 1907.) Price 21s. net.

THE large three-volume text-book of geology by Profs. Chamberlin and Salisbury has gained a firm place in this country owing to its full treatment of many questions, inadequately discussed in previous available English text-books. This companion volume on physical geography by Prof. Salisbury will accordingly be welcomed by British teachers of geology and geography. It is of great educational value owing to its wealth of lucid illustration and its clearness of exposition, while it will be indispensable as a reference work in geographical libraries owing to its detailed information regarding the physical geography of the United States.

The book is entitled "Physiography," but the term is used, as the author remarks in his introduction, as a synonym for physical geography, for it excludes many subjects which are included in physiography as that science was defined by Huxley and is accepted in the British Isles. The book consists in the main of a description of the structure of the earth's crust, of the working of the various agencies that attack it, and an account of the atmosphere and the oceans in so far as they affect the surface of the earth. Perhaps the most striking feature of the book is its illustrations, which are very numerous, well selected, and excellently reproduced. They are so clear that the author has been able to abridge his text, leaving his series of photographs to tell their own story. The excellence of the illustrations is probably in part secured by the use of heavy paper, so that the volume is of such weight as to hamper its use as a student's text-book.

As a book of reference its especial value is in its descriptions of the phenomena of physical geography taken from a country where the illustrations are unusually clear and suggestive; and it gives most useful summaries of such well-known geographical incidents as the San Francisco earthquake and of the fault which caused it; of the storm which destroyed Gal-

veston in 1900, and the tornado which devastated Louisville in 1896.

In the chapter on the "weather-maps," the author summarises various reasons for the failure of weather predictions, and he remarks that occasional mistakes are inevitable, and that one mistake is remembered longer than many correct forecasts. He claims that in many cases the American forecasts have been of immense economic value; for example, fifteen million dollars' worth of property were saved in 1897 by warnings of impending floods; on one occasion half a million dollars' worth of fruit about Jacksonville, in Florida, and during 1901, 3,400,000 dollars' worth of produce were saved by warnings of approaching cold; the forecasts also render it possible to avoid unnecessary risks, as when, in September, 1903, vessels valued at 585,000 dollars were detained in ports on the coast of Florida, and thus avoided a heavy storm.

In a work of so wide a scope there are naturally many points on which there is room for difference of opinion, but the author is cautious and fair in his treatment of all controverted questions. We are glad to find that he is emphatic in his statement that the term "Gulf Stream" is of doubtful propriety for anything beyond Newfoundland, and that the climate of north-western Europe would be much more temperate than that of corresponding latitudes of North America even if there were no Gulf Stream (pp. 544-5).

He holds that the only explanation of glacial periods which has not been discredited is that based on variations in the composition of the atmosphere. In his discussion of the question there is no criticism of Schloesing's view as to the control of the amount of atmospheric carbonic acid by the sea. The author is a firm adherent of the view of the ice erosion of fiords.

Each chapter is followed by a table of useful exercises, and by a list of references to literature. They are mainly from American sources, which is natural in a book designed for American students, but an English edition might have included more references to work easily available to British students; for instance, among the excellent illustrations and account of the eruption of Mt. Pelée and St. Vincent, there is no reference to the reports of Anderson and Flett. It may also be remarked that the Aconcagua ascent no longer holds the record, and that while it did, Zurbriggen was not the only man who had made it.

J. W. G.

POLYPERIODIC FUNCTIONS.

An Introduction to the Theory of Multiply-Periodic Functions. By Dr. H. F. Baker. Pp. xvi+33b. (Cambridge: University Press, 1907.) Price 12s. 6d. net.

THE saying that *Il n'y a que le premier pas qui coûte* certainly does not hold good of mathematics; and, oddly enough, it conspicuously fails in cases where it might be expected to justify itself. It is but a step from elliptic to hyperelliptic, from single to double Theta-functions; yet whereas Jacobi reduced all the essential theory of elliptic functions to a most elegant, and for some purposes a final,